07-21-04

IFW AF/2828



PTO/SB/21 (04-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE


# TRANSMITTAL FORM

*(to be used for all correspondence after initial filing)*

| | |
|---|---|
| Application Number | 09/867865-Conf. #9022 |
| Filing Date | May 29, 2001 |
| First Named Inventor | Vijayanand VUSIRIKALA |
| Art Unit | 2828 |
| Examiner Name | Q. P. Leung |
| Total Number of Pages in This Submission | |
| Attorney Docket Number | SYCS-002 |

## ENCLOSURES (*Check all that apply*)

- [x] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] After Allowance communication to Technology Center (TC)
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Return Receipt Postcard

Remarks

## SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

| | |
|---|---|
| Firm or Individual name | LAHIVE & COCKFIELD, LLP<br>Kevin J. Canning - 35,470 |
| Signature | Kevin J. Canning |
| Date | July 19, 2004 |

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as Express Mail, Airbill No. EL 981581651 US, in an envelope addressed to: MAIL STOP: APPEAL BRIEF – PATENTS, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below.

Dated: July 19, 2004 Signature: Kevin J. Canning (Kevin J. Canning)

PTO/SB/17 (10-03)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE


# FEE TRANSMITTAL for FY 2004

*Effective 10/01/2003. Patent fees are subject to annual revision.*

☐ Applicant claims small entity status. See 37 CFR 1.27

**TOTAL AMOUNT OF PAYMENT** ($) 330.00

| *Complete if Known* | |
|---|---|
| Application Number | 09/867865-Conf. #9022 |
| Filing Date | May 29, 2001 |
| First Named Inventor | Vijayanand VUSIRIKALA |
| Examiner Name | Q. P. Leung |
| Art Unit | 2828 |
| Attorney Docket No. | SYCS-002 |

## METHOD OF PAYMENT *(check all that apply)*

☐ Check ☐ Credit Card ☐ Money Order ☐ Other ☐ None

☒ Deposit Account:

Deposit Account Number: 12-0080

Deposit Account Name: Lahive & Cockfield, LLP

**The Director is authorized to:** *(check all that apply)*

☒ Charge fee(s) indicated below ☒ Credit any overpayments

☒ Charge any additional fee(s) or any underpayment of fee(s)

☐ Charge fee(s) indicated below, **except for the filing fee** to the above-identified deposit account.

## FEE CALCULATION

### 1. BASIC FILING FEE

| Large Entity Fee Code | Large Entity Fee ($) | Small Entity Fee Code | Small Entity Fee ($) | Fee Description | Fee Paid |
|---|---|---|---|---|---|
| 1001 | 770 | 2001 | 385 | Utility filing fee | |
| 1002 | 340 | 2002 | 170 | Design filing fee | |
| 1003 | 530 | 2003 | 265 | Plant filing fee | |
| 1004 | 770 | 2004 | 385 | Reissue filing fee | |
| 1005 | 160 | 2005 | 80 | Provisional filing fee | |

**SUBTOTAL (1)** ($) 0.00

### 2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

| | | | Extra Claims | | Fee from below | = | Fee Paid |
|---|---|---|---|---|---|---|---|
| Total Claims | | -** = | | x | | = | |
| Independent Claims | | -** = | | x | | = | |
| Multiple Dependent | | | | | | = | |

| Large Entity Fee Code | Large Entity Fee ($) | Small Entity Fee Code | Small Entity Fee ($) | Fee Description |
|---|---|---|---|---|
| 1202 | 18 | 2202 | 9 | Claims in excess of 20 |
| 1201 | 86 | 2201 | 43 | Independent claims in excess of 3 |
| 1203 | 290 | 2203 | 145 | Multiple dependent claim, if not paid |
| 1204 | 86 | 2204 | 43 | ** Reissue independent claims over original patent |
| 1205 | 18 | 2205 | 9 | ** Reissue claims in excess of 20 and over original patent |

**SUBTOTAL (2)** ($) 0.00

***or number previously paid, if greater; For Reissues, see above*

## FEE CALCULATION (continued)

### 3. ADDITIONAL FEES

| Large Entity Fee Code | Large Entity Fee ($) | Small Entity Fee Code | Small Entity Fee ($) | Fee Description | Fee Paid |
|---|---|---|---|---|---|
| 1051 | 130 | 2051 | 65 | Surcharge – late filing fee or oath | |
| 1052 | 50 | 2052 | 25 | Surcharge – late provisional filing fee or cover sheet. | |
| 1053 | 130 | 1053 | 130 | Non-English specification | |
| 1812 | 2,520 | 1812 | 2,520 | For filing a request for *ex parte* reexamination | |
| 1804 | 920* | 1804 | 920* | Requesting publication of SIR prior to Examiner action | |
| 1805 | 1,840* | 1805 | 1,840* | Requesting publication of SIR after Examiner action | |
| 1251 | 110 | 2251 | 55 | Extension for reply within first month | |
| 1252 | 420 | 2252 | 210 | Extension for reply within second month | |
| 1253 | 950 | 2253 | 475 | Extension for reply within third month | |
| 1254 | 1,480 | 2254 | 740 | Extension for reply within fourth month | |
| 1255 | 2,010 | 2255 | 1,005 | Extension for reply within fifth month | |
| 1401 | 330 | 2401 | 165 | Notice of Appeal | 330.00 |
| 1402 | 330 | 2402 | 165 | Filing a brief in support of an appeal | |
| 1403 | 290 | 2403 | 145 | Request for oral hearing | |
| 1451 | 1,510 | 1451 | 1,510 | Petition to institute a public use proceeding | |
| 1452 | 110 | 2452 | 55 | Petition to revive – unavoidable | |
| 1453 | 1,330 | 2453 | 665 | Petition to revive - unintentional | |
| 1501 | 1,330 | 2501 | 665 | Utility issue fee (or reissue) | |
| 1502 | 480 | 2502 | 240 | Design issue fee | |
| 1503 | 640 | 2503 | 320 | Plant issue fee | |
| 1460 | 130 | 1460 | 130 | Petitions to the Commissioner | |
| 1807 | 50 | 1807 | 50 | Processing fee under 37 CFR 1.17(q) | |
| 1806 | 180 | 1806 | 180 | Submission of Information Disclosure Stmt | |
| 8021 | 40 | 8021 | 40 | Recording each patent assignment per property (times number of properties) | |
| 1809 | 770 | 2809 | 385 | Filing a submission after final rejection (37 CFR 1.129(a)) | |
| 1810 | 770 | 2810 | 385 | For each additional invention to be examined (37CFR 1.129(b)) | |
| 1801 | 770 | 2801 | 385 | Request for Continued Examination (RCE) | |
| 1802 | 900 | 1802 | 900 | Request for expedited examination of a design application | |
| Other fee (specify) | | | | | |

*Reduced by Basic Filing Fee Paid **SUBTOTAL (3)** ($) 330.00

| SUBMITTED BY | | | | (Complete *(if applicable)*) | |
|---|---|---|---|---|---|
| *Name (Print/Type)* | Kevin J. Canning | *Registration No. (Attorney/Agent)* | 35,470 | *Telephone* | (617) 227-7400 |
| *Signature* | | | | *Date* | July 19, 2004 |

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as Express Mail, Airbill No. EL 981581651 US, in an envelope addressed to: MAIL STOP: APPEAL BRIEF – PATENTS, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below.

Dated: July 19, 2004 Signature: _____ (Kevin J. Canning)

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Vijayanand Vusirikala

Application number: 09/867,865

Filed: May 29, 2001

For: *METHOD AND SYSTEM FOR MODE STABILIZATION OF VCSELS USING INCREASING BIAS CURRENT*

Attorney Docket No.: SYCS-002

Group Art Unit: 2828

Examiner: Quyen Phan Leung

MAIL STOP: APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

"Express Mail" Mailing Label Number EL 981581651 US

Date of Deposit July 19, 2004

I hereby certify that this transmittal letter and the papers referred to as being enclosed therein are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to: MAIL STOP: APPEAL BRIEF – PATENTS, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Signature

Kevin J. Canning, Esq., Reg. No. 35,470
Please Print Name of Person Signing

## APPEAL BRIEF

As indicated in the Notice of Appeal filed on May 17, 2004, Appellant hereby appeals the final decision of the Examiner in the above-identified application rejecting the subject matter of the pending claims. In view of the reasons set forth below, Appellant respectfully requests the Board of Patent Appeals and Interferences to reverse the Examiner's final rejection of the claimed subject matter.

~~07/22/2004 AWONDAF1 00000002 120080 09867865~~
~~01 FC:1402 330.00 DA~~

07/22/2004 AWONDAF1 00000003 120080 09867865
01 FC:1402 330.00 DA

## I. REAL PARTY IN INTEREST

The real party in interest in the above-identified application is Sycamore Networks, Inc.

## II. RELATED APPEALS AND INTERFERENCES

No other appeals or interferences are known to Appellant, Appellant's legal representative or the assignees which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

## III. STATUS OF CLAIMS

Claims 1-22 are pending in the application.

Claims 1-22 are on appeal and are set forth in Appendix A.

## IV. STATUS OF THE AMENDMENTS

Amendment After Final filed on January 15, 2004 in response to the Final Office Action dated November 18, 2003 (Paper No. 9) was not entered.

## V. SUMMARY OF THE INVENTION

Appellant's invention pertains to a vertical cavity surface emitting laser (VCSEL) comprising:

an active region;

a contact region in at least one side of the active region providing current to be distributed through the active region; and

a stabilizer module for stabilizing modal gains of multiple modes of the VCSEL by increasing the current through the contact region, as described in Appellant's disclosure, for example, at least at page 3, line 1 through line 6.

Appellant's invention also pertains to a vertical cavity surface emitting laser (VCSEL) used in a multi-channel system, the VCSEL comprising:

an active region;

a contact region in at least one side of the active region providing current to be distributed through the active region; and

a stabilizer module for stabilizing modal gains of multiple modes of the VCSEL by increasing the current through the contact region, as described in Appellant's disclosure, for example, at least at page 3, line 8 through line 14.

Appellant's invention further pertains to a method for stabilizing modes in VCSEL, the method comprising:

generating a plurality of modes within said VCSEL;

determining whether the modes in the VCSEL are unstable based on changes in operating characteristics of the VCSEL;

generating an adjustable bias current for stabilizing the modes in the VCSEL; and

adjusting bias current of the VCSEL to stabilize the modes to compensate for the changes in the operating characteristics, as described in Appellant's disclosure, for example, at least at page 5, line 18 through line 26.

Appellant's invention still further pertains to a system for stabilizing modes in a VCSEL, the system comprises:

a first module in communication with a VCSEL, wherein said first module is used for determining whether the modes in the VCSEL are unstable based on changes of the operating characteristics; and

a second module in communication with a VCSEL, wherein said second module is used for adjusting bias current of the VCSEL to stabilize the modes to compensate for the changes in the operating characteristics, as described in Appellant's disclosure, for example, at least at page 4, line 30 through page 5, line 26.

Appellant's invention yet still pertains to a stabilizer module in communication with a VCSEL, the stabilizer module comprising:

a power module for measuring spatial and spectral power of the VCSEL;

a determination module for determining whether the spatial and spectral power of the VCSEL is unstable because of modal gains; and

a current module for increasing bias current to a level where the VCSEL is stable if it is determined that the VCSEL is not stable, as described in Appellant's disclosure, for example, at least at page 3, line 16 through line 22.

## VI. STATEMENT OF ISSUES PRESENTED FOR REVIEW

Appellant presents the following issues for review:

A. Whether claims 1-4, 6 and 22 are anticipated by Epworth (U.S. Patent No. 5,613,906).

B. Whether claims 5, 7-21 are obvious over Epworth in view of AAPA (Appellant's admitted prior art).

C. Whether claims 3, 6, 10, 14, 15, 19 and 20 are indefinite.

## VII. GROUPING OF CLAIMS

Claims 1, 4, 7, 11 and 16 are Appellant's principal claims on appeal and are also the only independent claims on appeal.

Claims 1-4, 6 and 22 stand and fall together.

Claims 5 and 7-21 stand and fall together.

## VIII. ARGUMENTS

### A. Claims 1-4, 6 and 22 Are Not Anticipated By Epworth

Claims 1-4, 6 and 22 are rejected under 35 U.S.C. §102(b) as being anticipated by Epworth. Appellant submits that the present invention is not anticipated by the Epworth reference because Epworth does not disclose each and every element of the present invention.

The present invention is directed, at least in part, to a vertical cavity surface emitting laser (VCSEL) comprising:

an active region;

a contact region in at least one side of the active region providing current to be distributed through the active region; and

a stabilizer module for stabilizing modal gains of multiple modes of the VCSEL by increasing the current through the contact region.

The Examiner relies on Epworth and rejects the present invention as being anticipated by the Epworth reference. To establish a *prima facie* case of anticipation, each and every element and limitation of the present invention must be disclosed expressly or inherently in a single prior art reference. *RCA Corp. v. Applied Digital Data Sys., Inc.*, 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984). For the reasons set forth below, it is Appellant's position that the Examiner has failed to establish a *prima facie* case of anticipation because Epworth does not disclose each and every element and limitation of the present invention.

The present invention recites a stabilizer module for stabilizing modal gains of multiple modes of the VCSEL by increasing the current through the contact region. Appellant submits that Epworth fails to disclose a stabilizer module for the VCSEL, as recited in claims 1 and 4. Epworth discloses a driver for the binary modulation of an edge

emitting laser. (See, Column 3, line 16 in Epworth). The driver disclosed in Epworth drives an edge emitting laser, not the VCSEL. Consequently, Epworth fails to disclose a stabilizer module for the VCSEL, as recited in claims 1 and 4.

In the Advisory Action mailed February 19, 2004, the Examiner notes that the recitation of the "VCSEL" has not given patentable weight because it is recited in the preamble of claims 1 and 4. Appellant submits that the limitation of the "VCSEL" is recited in the body portion of claims 1 and 4 as well as in the preamble of the claims. Appellant therefore submits that the Epworth reference does not disclose a stabilizer module for the VCSEL recited in the present invention.

Additionally, Appellant submits that the Epworth reference fails to disclose stabilizing modal gains of the multiple modes of the VCSEL, as recited in claims 1 and 4. Epworth discloses measuring the spectral purity of the emission of a laser that directly affects the chromatic dispersion penalty of an optical transmission system employing the laser. (See, column 2, lines 7-14 in Epworth). Epworth also discloses that the spectral purity of the laser emission may be determined by measuring the time-average coherence of that emission. (See, column 4, lines 40-42 in Epworth). Epworth further discloses that the spectral quality is stabilized by adjusting laser bias so as to minimize the total penalty. (See, column 6, lines 63-66 in Epworth).

The Epworth reference discloses enhancing the spectral purity or the time-average coherence of the emission of a laser by adjusting bias current of the laser. The spectral purity of a laser refers to the degree to which the laser output signal is monochromatic. In practice, a laser output signal is never perfectly monochromatic, i.e., a laser output signal always has a drift or changes in frequency. The drift or changes in frequency cause the chromatic dispersion when the laser output signal is transmitted through transmission lines. Epworth reduces the drift or changes in frequency by adjusting laser bias based on the measurement of

the spectral purity or the time-average coherence, and ultimately reduces the chromatic dispersion penalty.

In comparison, the present invention stabilizes modal gains of the multiple modes of the VCSEL. The modes of a laser refer to all the wavelengths satisfying the condition that the length of the cavity is integral multiple of half the wavelength in the cavity. Accordingly, the present invention stabilizes the gains of all the wavelengths that satisfy this condition. Appellant submits that the modes of a laser are different from the drift or changes in frequency described above in connection with the spectral purity of a laser output signal. The Epworth reference discloses the spectral purity control of a laser output signal, not the gain stabilization of multiple modes of a laser.

The Examiner notes in the Final Office Action that Epworth teaches that modal stabilization occurs with laser bias adjustment. Appellant respectfully disagrees and submits that the Examiner does not recognize the difference between the spectral purity of a laser output signal and the multiple modes of a laser. Epworth only discloses enhancing the spectral purity of a laser output signal by adjusting bias current of the laser. Epworth does not disclose stabilizing modal gains of multiple modes of a laser.

Furthermore, the spectral purity control of a laser output signal disclosed in the Epworth reference may apply to a single mode laser (See, Fig. 5 of Epworth) as well as a laser with multiple modes (See, Fig. 6 of Epworth). In contrast, the modal gain control of multiple modes applies only to a laser with multiple modes. Accordingly, the spectral purity control disclosed in Epworth cannot correspond to the stabilization of the modal gains of multiple modes of a laser.

Additionally, Appellant submits the Epworth reference fails to disclose that the stabilizer module stabilizes the modal gains of the multiple modes of the VCSEL by increasing the current through the contact region, as recited in claims 1 and 4. The Epworth

reference discloses in Fig. 5 decreasing of bias current of a laser to enhance the degree of coherence of the laser, which reduces the chromatic dispersion penalty in the optical system in which the laser is operating. Therefore, the Epworth reference does not disclose increasing bias current to enhance the spectral purity of a laser output signal.

The Examiner notes in the Final Office Action that Epworth does not exclude increasing laser bias in its discussion of laser bias adjustment relating to modal stabilization, and thus Epworth anticipates the present invention. Appellant respectfully disagrees. Epworth discloses adjusting the laser bias based on the measurement of the spectral purity or the degree of coherence of a laser output signal to keep the total penalty at a minimum. Appellant submits that although the adjustment of bias current does not exclude increasing of the bias current, the Epworth reference does not disclose increasing the bias current to enhance the spectral purity of a laser output signal.

For the reasons set forth above, it is Appellant's position that the Examiner has failed to establish a *prima facie* case of anticipation because Epworth does not disclose each and every essential element of the present invention.

**B. <u>Claims 5 and 7-21 Are Not Obvious Over Epworth In View Of AAPA</u>**

Claims 5 and 7-21 are rejected under 35 U.S.C. §103(a) as being unpatentable over Epworth in view of AAPA (Appellant's admitted prior art). It is the Appellant's position that the Examiner has failed to establish a *prima facie* case of obviousness because there is no motivation to combine the reference teachings and, even if combined, Epworth and AAPA do not teach or suggest all of the claim limitations of the present invention.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success.

Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in Appellant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP §2142.

The initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. "To support the conclusion that the present invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the present invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the present invention to have been obvious in light of the teachings of the references." *Ex parte Clapp*, 227 USPQ 972, 973 (BPAI 1985); MPEP §2142.

For the reasons set forth below, it is Appellant's position that the Examiner has failed to establish a *prima facie* case of obviousness because there is no suggestion or motivation to modify or combine the reference teachings and, even if combined, Epworth and AAPA do not teach or suggest all of the limitations of the present invention.

**B.1. <u>There is no motivation to combine the teachings of Epwoth and AAPA</u>**

Claims 5 and 7-21 are rejected as obvious over Epworth in view of AAPA. Appellant respectfully submits that there is no suggestion or motivation, either in the cited references or in the knowledge generally available to one of ordinary skill in the art for the following reasons.

Epworth describes a feedback control of an edge emitting laser using the measurement of the spectral purity or the degree of coherence of the emission of the laser.

AAPA introduces a VCSEL with general characteristics of the VCSEL.

Appellant submits that there is no motivation to combine the edge emitting laser control system taught by Epworth and the VCSEL taught by AAPA because the VCSEL has a different structure than the edge emitting laser taught by the Epworth reference. The

Examiner notes in the Final Office Action that the teachings of Epworth and AAPA can be combined because the VCSEL has a benefit over the edge emitting laser. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggest the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). The Examiner merely notes that the VCSEL has a benefit over the edge emitting laser. The Examiner does not suggest any desirability for combining the feedback control system for the edge emitting laser taught in Epworth and the VCSEL taught in AAPA.

On the other side, the VCSEL has a defect over the edge emitting laser that the VCSEL has a large ohmic resistance generating a relatively higher level of heat. This structural limitation of the VCSEL requires an efficient cooling system. Increasing the bias current of the VCSEL makes it more difficult to cool the heat generated in the VCSEL. For this reason, those of ordinary skill in the art would not be motivated to employ technologies used with the edge emitting laser to control bias current of the VCSEL because the edge emitting laser does not require such an efficient cooling system as the VCSEL.

Therefore, it is the Appellant's position that there is no suggestion or motivation, either in the cited references or in the knowledge generally available to one of ordinary skill in the art, to combine the teachings of these references.

**B.2. <u>Epworth and AAPA fail to teach or suggest all of the claim limitations</u>**

Claims 5 and 7-21 are rejected as obvious over Epworth in view of AAPA. Appellant argues above why there is no motivation to combine Epworth and AAPA. The Examiner asserts that the combination of the teachings of Epworth and AAPA results in the present invention. For the reasons set forth below, it is Appellant's position that the Examiner has failed to establish a *prima facie* case of obviousness because Epworth and AAPA, even if combined, do not teach all of the limitations of the present invention.

Claim 5 is directed, at least in part, to a vertical cavity surface emitting laser (VCSEL) used in a multi-channel system, the VCSEL comprising:

an active region;

a contact region in at least one side of the active region providing current to be distributed through the active region; and

a stabilizer module for stabilizing modal gains of multiple modes of the VCSEL by increasing the current through the contact region.

Claim 7-10 are directed, at least in part, to a method for stabilizing modes in VCSEL, the method comprising:

generating a plurality of modes within said VCSEL;

determining whether the modes in the VCSEL are unstable based on changes in operating characteristics of the VCSEL;

generating an adjustable bias current for stabilizing the modes in the VCSEL; and

adjusting bias current of the VCSEL to stabilize the modes to compensate for the changes in the operating characteristics.

Claims 11-15 are directed, at least in part, to a system for stabilizing modes in a VCSEL, the system comprises:

a first module in communication with a VCSEL, wherein said first module is used for determining whether the modes in the VCSEL are unstable based on changes of the operating characteristics; and

a second module in communication with a VCSEL, wherein said second module is used for adjusting bias current of the VCSEL to stabilize the modes to compensate for the changes in the operating characteristics.

Claim 16-19 are directed, at least in part, to a stabilizer module in communication with a VCSEL, the stabilizer module comprising:

a power module for measuring spatial and spectral power of the VCSEL;

a determination module for determining whether the spatial and spectral power of the VCSEL is unstable because of modal gains; and

a current module for increasing bias current to a level where the VCSEL is stable if it is determined that the VCSEL is not stable.

Claim 21 is directed, at least in part, to a vertical cavity surface emitting laser (VCSEL) comprising:

an active region;

a contact region in at least one side of the active region providing current to be distributed through the active region; and

a stabilizer module for stabilizing modal gains of multiple modes of the VCSEL by increasing the current through the contact region.

Appellant submits that Epworth and AAPA, in combination, fail to teach stabilizing the modes of the VCSEL by increasing or adjusting bias current, as recited in claims 1, 4, 7, 11 and 16. Epworth teaches a feedback control of a laser by measuring the spectral purity of the emission of the laser that directly affects the chromatic dispersion penalty of an optical transmission system employing the laser. (See, column 2, lines 7-14 in Epworth). Epworth also teaches that the spectral purity of the laser emission may be determined by measuring the time-average coherence of that emission. (See, column 4, lines 40-42 in Epworth). Epworth further teaches that the spectral quality is stabilized by adjusting laser bias so as to minimize the total penalty (See, column 6, lines 63-66 in Epworth).

The Epworth reference teaches the spectral purity or the time-average coherence of the emission of a laser. The spectral purity refers to the degree to which a laser output signal is monochromatic. In practice, a laser output signal is never perfectly monochromatic, i.e., the laser output signal always has a little drift or changes in frequency. The little drift or changes

in frequency come from non-deterministic signals, such as noises, and cause the chromatic dispersion when the signal is transmitted through transmission lines. The Epworth reference teaches measuring of the spectral purity or the time-average coherence of the emission of a laser output signal and adjusting bias current of the laser based on the measurement of the spectral purity or the time-average coherence to reduce the chromatic dispersion penalty.

In comparison, the present invention stabilizes the modes of the VCSEL by adjusting or increasing bias current. The modes of a laser refer to all the wavelengths satisfying the condition that the length of the cavity is integral multiple of half the wavelength in the cavity. Accordingly, the present invention stabilizes the gains of all the wavelengths that satisfy this condition. Appellant submits that the modes of a laser are different from the drift or changes in frequency described above in connection with the spectral purity of a laser output signal. The Epworth reference teaches the spectral purity control of a laser output signal, not the stabilization of modes of the VCSEL.

The Examiner notes in the Final Office Action that Epworth teaches modal stabilization occurs with laser bias adjustment. Appellant respectfully disagrees and submits that the Examiner fails to give weight to the difference between the spectral purity of a laser output signal and the multiple modes of a laser. Epworth teaches enhancing the spectral purity of a laser output signal by adjusting the bias current of the laser. Epworth does not teach stabilizing modal gains of multiple modes of the VCSEL.

Furthermore, the spectral purity control of a laser output signal taught in the Epworth reference may apply to a single mode laser (See, Fig. 5 of Epworth) as well as a multiple modes laser (See, Fig. 6 of Epworth). In contrast, the modal gain control of multiple modes applies only to a multiple modes laser. Accordingly, the spectral purity control taught in Epworth cannot correspond to the stabilization of modal gains of multiple modes of a laser.

For the reasons set forth above, it is Appellant's position that the Examiner has failed to establish a *prima facie* case of obviousness because Epworth and AAPA, either alone or in combination, do not teach or suggest all of the claim limitations of the present invention.

**C. Claims 3, 6, 10, 14, 15, 19 And 20 Are Not Indefinite**

Claims 3, 6, 10, 14, 15, 19 and 20 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Examiner notes in the Final Office Action that it is unclear what further structural limitations are being implied by that recitation of intended use.

Appellant respectfully submits that claims 3, 6, 10, 14, 15, 19 and 20 add to one of independent claims 1, 4, 7, 11 and 16 the limitation that the VCSEL is adapted to position in high speed communication links over a multimode fiber or in applications of 1.2 Gb/s and 2.5 Gb/s frequencies. The added limitation defines the claims by what it does rather than what it is. Applicants can describe some parts of the claims in functional terms. Functional language does not, in and of itself, render a claim improper. *In re Swinehart*, 439 F.2d 210, 169 USPQ 226 (CCPA 1971).

In the Advisory Action, the Examiner notes that a recitation of the intended use of the present invention must result in a structural difference between the present invention and the prior art in order to patentably distinguish the present invention from the prior art. Appellant submits that claims 3, 6, 10, 14, 15, 19 and 20, which depend on one of independent claims 1, 4, 7, 11 and 16, incorporate the patentable structure of the independent claims. Appellant therefore submits that claims 3, 6, 10, 14, 15, 19 and 20 recite a patentably distinct structure over the cited prior art.

For the reasons set forth above, it is Appellant's position that claims 3, 6, 10, 14, 15, 19 and 20 are not indefinite.

## IX. CONCLUSION

In light of the foregoing arguments, Appellant submits that pending claims 1-22 are patentable and respectfully request the Board to reverse the Examiner's final rejection of claims 1-22.

Respectfully submitted,
LAHIVE & COCKFIELD, LLP

By: _____
Kevin J. Canning, Esq.
Registration No. 35,470
Attorney for Appellant

28 State Street
Boston, MA 02109
(617) 227-7400

Dated July 19, 2003

**APPENDIX A**

1. A vertical cavity surface emitting laser (VCSEL) comprising:

an active region;

a contact region in at least one side of the active region providing current to be distributed through the active region; and

a stabilizer module for stabilizing modal gains of multiple modes of the VCSEL by increasing the current through the contact region.

2. The VCSEL as recited in claim 1 wherein the VCSEL is an oxide VCSEL.

3. The VCSEL as recited in claim 1 wherein the VCSEL is adapted to use in high-speed communication links over a multimode fiber.

4. A vertical cavity surface emitting laser (VCSEL) used in a multi-channel system, the VCSEL comprising:

an active region;

a contact region in at least one side of the active region providing current to be distributed through the active region; and

a stabilizer module for stabilizing modal gains of multiple modes of the VCSEL by increasing the current through the contact region.

5. The VCSEL as recited in claim 4 wherein the VCSEL is an oxide VCSEL.

6. The VCSEL as recited in claim 4 wherein the VCSEL is adapted to use in high-speed communication links over a multimode fiber.

7. A method for stabilizing modes in VCSEL, said method comprising:

generating a plurality of modes within said VCSEL;

determining whether the modes in the VCSEL are unstable based on changes in operating characteristics of the VCSEL;

generating an adjustable bias current for stabilizing the modes in the VCSEL; and

adjusting bias current of the VCSEL to stabilize the modes to compensate for the changes in the operating characteristics.

8. The method as recited in claim 7 wherein the VCSEL is an oxide VCSEL.

9. The method as recited in claim 7 wherein the step of adjusting bias current further comprises adjusting bias current up to a saturation level of the VCSEL.

10. The method as recited in claim 7 wherein the VCSEL is adapted to use in high-speed communication links over a multimode fiber.

11. A system for stabilizing modes in a VCSEL, said system comprises:

a first module in communication with a VCSEL, wherein said first module is used for determining whether the modes in the VCSEL are unstable based on changes of the operating characteristics; and

a second module in communication with a VCSEL, wherein said second module is used for adjusting bias current of the VCSEL to stabilize the modes to compensate for the changes in the operating characteristics.

12. The system as recited in claim 11 wherein the VCSEL is an oxide VCSEL.

13. The system as recited in claim 11 wherein the bias current is adjusted up to the saturation level of the VCSEL.

14. The system L as recited in claim 11 wherein the VCSEL is adapted to use in applications of 1.2 Gb/s and 2.5 Gb/s frequencies.

15. The system as recited in claim 11 wherein the VCSEL is adapted to use in high-speed communication links over a multimode fiber.

16. A stabilizer module in communication with a VCSEL, the stabilizer module comprising:

a power module for measuring spatial and spectral power of the VCSEL;

a determination module for determining whether the spatial and spectral power of the VCSEL is unstable because of modal gains; and

a current module for increasing bias current to a level where the VCSEL is stable if it is determined that the VCSEL is not stable.

17. The stabilizer module as recited in claim 16 wherein the VCSEL is an oxide VCSEL.

18. The stabilizer module as recited in claim 16 wherein the current module adjusts bias current up to the saturation level of the VCSEL.

19. The stabilizer module as recited in claim 16 wherein the VCSEL is adapted to use in applications of 1.2 Gb/s and 2.5 Gb/s frequencies.

20. The stabilizer module as recited in claim 16 wherein the VCSEL is adapted to use in high-speed communication links over a multimode fiber.

21. The VCSEL in accordance with claim 1, wherein said active region is defined by a plurality of mirror stacks.

22. The VCSEL as recited in claim 1 wherein instability of the modal gains is induced by spatial power instability in the active region.